# The Role of Lithosphere Structure and Large-Scale Mantle Flow in the Forces that Affect Central and Eastern North America

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In this paper we present an overview of the origin of stresses that impact the North American plate. This overview is based on the perspective provided by global three-dimensional modeling that accounts for the effects of topography, lithosphere structure, lithosphere coupling with mantle flow, and lateral strength variations within the lithosphere itself. The USArray portion of EarthScope has provided researchers the opportunity to determine details regarding crust and upper mantle structure. These model results are now providing new vital constraints on the distribution of body forces within the lithosphere. New details are also emerging from seismic tomography studies. Tomography results can be used to infer density distributions within the mantle, which drive mantle flow. This mantle flow gives rise to radial and tangential tractions at the base of the lithosphere, which impacts the stress field within the lithosphere. We use a finite element approach to calculate lithosphere stresses, strain rates, and surface motions arising from the effects of (1) topography and lithosphere structure, and (2) coupling with 3-D mantle flow. Models possess both radial and lateral (lithosphere) viscosity variations. Model results are compared with plate motions, and stress orientations from the World Stress Map (WSM). We test a variety of recent tomography models, and also a range of radial viscosity profiles. The dominant mantle flow pattern that has a profound influence on stresses and deformation patterns within North America is associated with the history of subduction of the Farallon Plate. The mantle flow pattern from this Farallon subduction history has a dominant influence on stresses within eastern North America, but stresses there are also strongly modulated by the crustal structure variations from the Appalachians into the continental margin setting. Another important factor involves the distribution of lateral strength variations within the lithosphere, inherited from past tectonic events. Characterizing these features, along with the influence or internal body forces and coupling with mantle flow remains an important challenge for understanding active faulting within CEUS.